EFFECT OF INDOOR AIR ON THE HEALTH OF RESTAURANT WORKERS- A CASE STUDY

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INTRODUCTION

Biomass and fossil fuels are burnt indoors for heating, cooking and aesthetic purposes. Combustion mostly occurs at air fuel ratios different from stoichiometric conditions. The resulting incomplete combustion produces gaseous pollution such as NOx, SOx, CO2, CO as well as water vapours and particulate matters. Where combustion occurs indoors and the emissions are not directly vented out. Elevated concentration of air containments can occur.

Pollutant emission from domestic and commercial cooking activities is a previously neglected area of concern with respect to human health worldwide. Its health effects are relevant to people across the globe, not only those using low quality food materials in lesser-developed countries but also to more affluent people enjoying higher quality food in developed countries.
But there is lack of well co-ordinated study to find out the different sources of Indoor pollutants, its detection, its effect on health and its control. One of the major motivations behind undertaking this project was the unavailability of much literature on this topic. Therefore it is essential to study the indoor air quality in cafeterias and for this purpose the college cafeteria was chosen.

This paper also takes a step towards understanding the relationship between oil vapour content in cafeterias and their impact on the health of workers working there. One of the other major reasons for us to take this topic for the project is the low awareness levels of the general public towards the ill-effects of inhalation of excessive oil vapours.

So the main aim and objectives of this study can be listed as follows:

- To investigate the proper indoor exposure detection technique.
- To detect the indoor air pollution sources and measure the indoor exposure level of oil vapours, carbon monoxide and S.P.M & R.S.P.M
- To monitor its effect on health of workers.

**METHODS**

The project is aimed at investigating the indoor air quality in the college cafeteria and understanding its effects on the health of workers as already explained. For better co-ordination the study was divided into 3 phases:

**Phase I:** Investigation of area under study and the sites at which sampling is to be undertaken. Also includes checking the equipment to be used and doing the groundwork for subsequent sampling.

![Kitchen of the Cafeteria were sampling was done](image)
**Phase II:** The sampling was done for the period March 2013 to May 2013 and the sampling time was chosen so as to coincide with the college working hours i.e. 9 am – 5 pm. Hence the duration of the sampling was 8 hours. Sampling of SPM was done by using APM 800 Envirotech model and analysis was done by gravimetric method. Concentration of oil vapours was done by soxhlet extraction method using petroleum ether as extracting media. Determination of carbon monoxide content in the indoor sampling was conducted using plastic air bags. Composite sampling was carried out as the air samples were collected with the help of suction pumps in air-tight bags. The instrument used for analysis was the CO12M carbon monoxide (CO) analyser i.e. Non Dispersive Infra Red (NDIR) GFC CO analyser.

![Figure 3. Envirotech model APM 800 placed for sampling in the kitchen](image)

**Phase III:** Studying health status of workers in the kitchen by using a questionnaire distributed to all the workers.

**RESULTS**

Based on the sampling and analysis described earlier the following results were obtained:

![Figure 4: Bar chart comparison of mean S.P.M. values with the respective standard values](image)
The Standard values are the National Ambient Air Quality Standards (NAAQS)

Figure 4. reveals the S.P.M. values (mg/m$^3$) in Kitchen is higher than the standard permissible values (0.05 mg/m$^3$)

![Bar chart comparison of mean CO values with the respective standard values](image1)

**Figure 5:** Bar chart comparison of mean CO values with the respective standard values

A high concentration of CO is not expected to be generated in modern kitchens due to use of clean fuels such as LPG (liquefied petroleum gas). But still it is observed that the concentration of CO is above the standard permissible limit in the kitchen (2 mg/m$^3$).

Oil vapour concentration was measured and it was found average oil fume concentration in the kitchen was 1.239 mg/m$^3$. The lack of any globally/nationally recognised standards for oil fumes/organic vapours concentration in air is a major hindrance in trying to analyse results. The recorded values for oil fumes indoors do seem relatively high but due to no available standards for this parameter no conclusive results can be drawn on back of these recorded values. The major source for these oil vapours in the indoor air is the burning of cooking oil used excessively for frying as a cooking medium in the cafeteria.

![Bar chart comparison of mean R.S.P.M. values with the respective standard values](image2)

**Figure 6:** Bar chart comparison of mean R.S.P.M. values with the respective standard values
Figure 6 shows the mean RSPM value with the respective standard value and it is found it is higher than the standard value 0.02mg/m³.

The questionnaires prepared for analysis of the impact of indoor air quality on health of workers were distributed amongst the workers. Their responses were duly noted and the filled questionnaires were then analysed and scrutinised. The following results were obtained after the study of the forms:

- Majority of the workers complained of headache and tiredness due to the working conditions and excessive working hours.
- Almost all of the workers were dissatisfied with the ventilation provisions in the kitchen. The lack of a proper chimney was the most common complaint of 80% of the workers.
- As most of the workers had been working in the cafeteria for a long time (more than 2-3 years) they had become accustomed to the high oil/organic vapour concentration in the indoor air. 70% claimed it affected them earlier but now they had become used to it.
- There were no elderly workers but children had been employed and they were amongst the most vociferous complainants. They complained of vomiting and serious headaches.
- As all the workers were from rural or semi-urban areas they were accustomed to slightly higher concentrations of contaminants in the air and therefore they didn’t have any major complaints apart from the severe lack of proper ventilation.
- Social and economic constraints were also important factors that were responsible for the workers not being completely honest and continuing to work in a poor working environment.

CONCLUSIONS

It can be concluded from the above results that the indoor air quality inside cafeterias is poor and that it has adverse health effects on the workers. The study exhibited various results which are listed below:

- Very High concentration of Suspended Particulate Matter (S.P.M.) in the indoor air in cafeterias
- Moderate concentration of Carbon Monoxide in the indoor air in cafeterias
- Average concentration of Oil fumes/Organic vapours in the indoor air in cafeterias
- High concentration of Respirable Suspended Particulate Matter (R.S.P.M.) in the indoor air in cafeterias
- The major health complaints by workers are of: headache and tiredness, caused mainly by inhalation of oil fumes/organic vapours.
- Relative health risk to a worker due to the poor indoor air quality exists and has been ignored till now.

Based on the study it is recommended that more research work should be done on the topic and published so that the cafeteria workers and the general public become more aware of the adverse health effects of the poor indoor air quality in cafeterias. The cafeteria workers should be provided with personal protection units (PPU) like gloves, glasses, masks etc. to help them work safely. Also it is recommended that the ventilation facilities inside the kitchen be improved by providing chimneys which would result in better indoor air quality in the cafeteria.
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